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ABSTRACT

Research on the use of computers with young handicapped children is summarized. Much of the literature on the topic, it is noted, is speculative; few students are technically sound. Findings are briefly reviewed in terms of the amount of time spent using the computer, social and free play choices, software selection preferences, amount of teacher assistance required, and computer access considerations. An examination of existing software suggests that the majority of the programs use the keyboard as a primary means of response, a level of skill that many young handicapped children do not possess and that many programs have been developed without an adequate research base. Access considerations are also covered, and a procedure for assessing a child's computer abilities outlined in six steps is described. The importance of examining a child's skills--both physical and cognitive--is emphasized in determining if access to the use of computers will be beneficial. (CL)

Applications of Microcomputers in Early Childhood Special Education

by Michael Rettig, Ph.D.

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INTRODUCTION

The last few years has seen a rapid growth in the use of microcomputers with young nonhandicapped and handicapped children. There have been increases in the number of computer projects serving this population as well as increases in the availability of software. There has also been increases in the number of articles published which discuss the use of computers by young children.

My interest in the use of computers by young handicapped children goes back many years. My work with the Handicapped Children's Computer Cooperative Project allowed me to look at the use of computers with handicapped children with varying handicaps and severity levels. One important factor in the use of computers by this population, which I will discuss later, is the importance of computer access. That is, how children use and interact with the computer systems.

Despite the growing interest and use of computers with this population it is important to still look critically at the use of computers. An important question that should be addressed, for example, is when do we start using computers with these children? Another equally important question is what do we hope to accomplish by using computers with these

children? The answer to these questions of course differs with whom you talk to and varies in the literature.

For handicapped children computer technology can be an important prothestic device. Computer technology can serve as a tool which can increase a child's communication or environmental control. In terms of the use of computers for augmentative communication, Van Tatenhove (in press) suggests than an early beginning in the use of technology can (1) reinforce oral communiation, (2) promote cognitive development, and (3) allevate failures in communication which can occur early.

I would like to mention in passing, that when to begin using computers and what is hoped to be gained in using computers, may differ by handicapped and nonhandicapped children. Some of the concerns relevant to communication and fostering independence for handicapped children are not so important for nonhandicapped children. For nonhandicapped children the computer seems to be little more than a fancy toy. This is perhaps the way computers should be viewed when using them with hanicapped young children as well.

As a way of examining and understanding the use of microcomputers with young handicapped children I would like to focus on three different, but interrelated, areas. These areas include (1) a look at the literature available to date, (2) a look at the available software suitable for this

age group, and (3) a look at computer access and adaptive equipment considerations.

LITERATURE

As with software and adaptive equipment, the available literature discussing computer use by young children as increased in the last few years. I've had an opportunity to examine a broad array of this literature, particularly that literature relevant to young handicapped children. Recently I had an opportunity to review an article by Goodwin, Goodwin, and Garel (1986), from an issue of Early Childhood Research Quarterly. In this article, Goodwin, Goodwin, and Garel reviewed more than 90 articles and research studies on the use of computers by young children. Combined with the articles I already had or knew about I will be reporting on more than 150 articles.

The information obtained from reviewing this literature reveals that little research information is available on the use of computers by either handicapped or nonhandicapped young children. Of the more than 150 articles only about 15 or 10% could be said to be good experimental studies. Goodwin, Goodwin, and Garel reported that they found only five studies conducted with preschoolers that followed a good experimental design. Of the more than 20 studies they identified most were descriptive studies that suffered from poor sampling, analysis, or design.

The majority of what is found in the literature is made up of what could be described as speculation. This

speculation on the use of computers by young children is of both positive and negative points of view. In terms of positive speculation you will find such points as increasing alphabet and number recognition, increases in cooperation and self-esteem, and increases in the child's understanding of spatial relations and symbolic representation. Articles which encompass the negative points of view suggest that computer use by young children is inappropriate because of a lack of appropriate software and a lack of teacher training. Further, these articles suggest that young children lack important requisite skills to use the computer and can not use the computer without adult assistance.

What studies are available have looked at the use of computers with young children in terms of amount of time using the computer, social and free play choices, software selection preferences, amounts of teacher assistance required, and computer access considerations.

In regards to the amounts of time children spend using computers, the literature suggests that children will spend on the average about six minutes using the computer at one sitting (Fazio & Reith, 1986). This time, of course, depends on the child, the software being used, the child's age, and experience using the computer. Older children will tend to spend greater amounts of time using the computer, averaging 8-9 minutes at a sitting. Younger children may spend only 3-4 minutes at one sitting (Shade, Daniel, Nida, Lipinski & Watson, 1983). It has also been suggested that

children may use as many as 3-4 different software programs in a 10 minute time period.

The time on task findings is consistent with what I find with my own child. He is a three and one-half year old who has free access to the computer. He will frequently 'play' with as many as four software programs in 10 minutes. Part of this change of programs, however, would seem to be due to the fact that he enjoys opening and closing the disk drive, turning the computer on and off and simply manipulating the equipment.

In regards to findings on social and free play behaviors the literature would suggest that children's social interactions while using the computer are similar to the social interactions in other play settings. Further, children who use the computer are not isolated from their peers. Other play activities in a classroom, such as block or dramatic play activities, still seem to be more popular than computer activities. One study reported that children only selected computer tasks in 6% of their free play choices (Niebor, 1983). Additional findings in terms of teacher presence and teacher behavior suggest that the presence of the teacher fostered greater interaction and interest with the computer. Teacher assistance was required less for older children and more so for younger children.

The suggestion that children will be more involved and interested in computer activities with a teacher being present is also consistent with what I find with my own

children. They are much more likely to stay involved in the computer activity longer if I'm there and involved in the activity with them.

Additional information in the literature has looked at software selection preferences by young children. The results are probably not surprising. The children seem to prefer problem solving/discovery oriented software over drill and practice software. The types of programs that seem most appealing are those in which children can press any key and get sound, music, or animation (Sherman, Divine & Johnson, 1985).

One research study (Rettig, 1984) looked at computer access considerations with young handicapped children. Although some reports suggest that young children are capable of using the keyboard, these same reports will also point out that young children often press the keys at random just to see what will happen.

In the study I conducted, I looked at four different computer response/input methods. These included a keyboard, keyboard with adaptor, light pen, and hand paddles. A total of 40 preschool-aged handicapped children used each response mode in a different order for a color matching activity. In short, the results of the study indicated that the keyboard response mode was the least effective input method of the four examined. In terms of both the children's frequency and accuracy of responding the keyboard was shown to be

ineffective. None of the other response/input methods was shown to be superior to the others, however.

In a related, more informal study, I used the Touch Window touch screen as the method of input. Using the same color matching task, adapted to receive input from the touch screen, I evaluated the children's responses to the color matching task. Whereas accuracy of responding ranged from 21% to 55% in the first study, the children's accuracy of responding using the touch screen ranged from 53% to 89%. This finding, along with my experiences over the last four years, would suggest that touch screen input methods would be the most appropriate for young children to use. Touch screen technology offers young children with a direct and natural form of response. It provides a form of input which is fast, fun, and easy. Interactiviness is fostered and attention can be focused directly on the monitor screen.

In regards to the literature then, what can we conclude? In short, there is a great deal more to learn. There is a definite need for more research in this area, especially longitudinal studies. We still must address, also, the questions of what do we hope to achieve, and when do we start using computers with young children?

SOFTWARE

Before moving on to computer access conderations, I would like to look briefly at the software available for young children. From such sources as the Special Education Software Center and Closing The Gap, I identifed more than

150 software programs designed for young children. A close look at these programs reveals some interesting findings. Of the 150 programs available approximately 75% or 116 of these programs will run on Apple computers. The remaining 25% of the programs run on other computer systems. Approximately 78% of the software currently on the market for young children uses the keyboard as the primary means of input and response. The remainding 22% of the programs use expanded keyboards, touch screens, light pens, etc. Of the 150 programs examined only 15% of these programs use speech output. Finally, of the 150 programs reviewed approximately 69% of these programs focused on pre-reading, language arts, or basic cognitive skill development.

I find this closer examination of software interesting. First, that so many programs use the keyboard as the primary means of response to the computer would require the presence of skills that many children may not have. In an article by Porter, Lahm, Behrmann, and Collins (1986) it is suggested that software developers make assumptions about children's skill levels. In the case of input I would suggest that this is correct. Handicapped children, in many cases, will not have the skills to use the keyboard appropriately without training.

In short, although there are many software programs available on the market, I would sugest that many of these programs have been developed without an adequate research base. In many cases software developers have developed

programs with little uderstanding of what young children can and can not do. Further, I would suggest that many software developers have developed programs without a clear understanding of what features appeal to children and what features will enhance the quality and usefullness of the program.

ACCESS ASSESSMENT

I would like to turn now to a look at computer access considerations for microcomputer applications. For many years I have been interested in trying to develop procedures through which a child's computer access abilities could be assessed. In recent years a number of assessment instruments have been developed to help teachers and therapists assess a child so that appropriate types of adaptive equipment can be selected. Such sources of assessments are the state wide projects in Florida and Pennsylvania. However, a limitation of these assessment tools is that they are not specifically developed for early childhood education.

In general, these assessment tools look at such things as a child's motor, speech, and communication skills. These instruments follow an interdisciplinary approach and utilize speech therapists as well as occupational and physcial therapists. I would like to suggest that the involvement of several disciplines is important and is even more important when children are severely disabled.

In assessing a child's computer abilities I would like to suggest that there is basically a six step process. The first step involves finding out about what types of adaptive devices are available. Such sources as the Trace Research and Development Center and Closing The Gap are useful in getting information on adaptive equipment. It is critically important that assessments be conducted on a child, however, before any equipment is purchased.

A second step in this process is to assess the child's abilities. As a part of this process it is important to understand the child's needs. The assessment should identify the child's most appropriate anomtic body site, look at positioning considerations, and include an assessment of the child's cognitive skills.

The third step in this process is to identify what types of equipment will be appropriate for the child. This is a type of 'first cut' or elimination of devices which will not be appropriate for the child. A related fourth step is to determine how the child will interact with the adaptive equipment. That is, how will the child use the equipment. This could involve an examination of how the child's positioning and body part used interacts with the device.

The fifth step involves a comparative testing of the equipment, body site locations, positioning, etc. In this part of the process you should look at a child's accuracy of responding or using the equipment. In addition, look at the time it takes the child to respond and/or learn how to use

the equipment. Further, it would be important to assess the child's fatique in using different types of equipment (Barker and Cook, 1981).

There is a growing avialability of software which can help you assess these factors. One piece of software which I have used is the Single Input Assessment Program, from the Ontario Crippled Children's Centre in Canada. This program allows you to assess different types of single switches used by a child who may be using different body parts to make their response to computer stimuli. The mportance of this step can not be stressed enough, because it is at this step that you can work at reducing error likely operations the child may have with the equipment.

The final step, of course, is to choose and implement the equipment with the child. Post use feedback by the child is important to ensure that the proper selection of equipment has been made.

I would like to discuss in a little more detail the importance of looking at a child's skills. It is important to recogonize that a child's skills will change over time, for either better or worse. Hence, adaptability of equipment is important.

I have talked before about looking critically at different pieces of equipment for the skills needed to operate them. That is, what skills are required for a child to use a particular piece of equipment. For example, certain fine motor and range of motion skills would be

required to use several types of adaptive equipment. Expanded keyboards would require large amounts of range of motion and a certain level of fine motor skills. The standard keyboard would require less range of motion, but may require more fine motor skills. Single switches would require little if any range of motion and little fine motor control.

A child's physical abilities are important, but I would like to suggest that with young handicapped children cognitive skills are even more important. The use of equipment such as the Adaptive Firmware Card requires a certain level of cognitive abilities which many young handicapped children may not have yet obtained. As an example of what I mean I would like to draw from an article by Porter, Lahm, Behrmann, and Collins (1986). In this article the authors outline at least five steps a child must work through to scan objects on a monitor screen. These steps include: (1) survey the options available, (2) make a decision, (3) note where the scanner is located, (4) visually track the scanner, and (5) initiate the motor movement to make the selection. I would suggest that for many young and/or low functioning handicapped children that this sequence of five skills would be too difficult.

I have tried to identify some of the many skills that would be required by young handicapped children before they could use many types of adaptive computer equipment. This listing of motor and cognitive skills will have varying

levels of importance depending on the child and the equipment being used. In the motor area at least seven skills would be needed these include:

(1) reliable motor movement
(2) range of motion
(3) press and release,
(4) controlled pressure
(5) eye-hand coordination
(6) visual attention,
(7) visual tracking.

In the cognitive area I would list at least 10 skills that may be needed. These skills include:

(1) cause and effect
(2) attention span
(3) object permanence,
(4) means-ends causality,
(5) imitation
(6) one-to-one correspondence
(7) intentional behavior
(8) symbolic representation
(9) reliable yes/no response
(10) the ability to understand the task being presented.

Additional skills that may also need to be assessed would include the child's receptive language abilites and the ability to follow directions.

It should be obvious that many skills are required by young handicapped children if they are to successfully use computers and adaptive equipment. Understanding what skills are required is important in establishing training procedures to teach the children these skills.

There is, fortunately, a number of projects or software programs available which can assist in training young handicapped children some of these needed skills. As examples are such projects as ACTT at Western Illinois University in Macomb. In software Choice Maker I and The

Rabbit Scanner are examples of software which help children learn some of the skills required to scan.

SUMMARY

There is still much be to learned about the most appropriate use of computers with young handicapped children. My purpose today was to try to give you a sense of what we know and to identify some questions that need to be addressed. I would be interested in making contact with others who are interested in this area to exchange resources and information. I can be contacted at the following address:

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